APPARATUS FOR MACHINING A HUB BEARING UNIT FOR A WHEEL OF A MOTOR VEHICLE

DESCRIPTION

The invention finds industrial utilisation in the machine tools for the working on industrial scale of the units with bearings and with flange suitable to carry the disk of the brakes for the hubs of the wheels of the motor vehicles, to effect the precision machining the surface of said flange, with the object of reducing the effects of the so-called runout or wobble caused by the small working and assembling tolerances of the bearings and of the other portions of the unit which is referred to. This technology is for example described in the patent applications PCT/US00/14187 (TIMKEN) and PCT/EP00/11684 (SKF). Both these patent applications are focused to effect the machining for the above mentioned purposes, of a unit made by a box suitable to be fixed to the frame or the steering portions of the motor vehicle and in which there is axially assembled in a rotatable manner with the interposition of bearings, a hub which is axially hollow for the possible connection to a rotation shaft and which is provided at one end with a flange which carries perpendicularly projecting screw studs which pass through corresponding holes of the braking disk which is then fixed on this flange with screws, while the said screw studs are then used to fix to the hub, with suitable screw nuts, the rim of the wheel of the motor vehicle. The above mentioned patent applications, provide to keep steady the external box of the unit, to cause the hub to rotate around its axis by charging it axially and finally to machine with the machine tool the surface in view of the flange of the hub on which there will be assembled the disk of the brakes.

Only in the patent application PCT/EP00/11684 (SKF) there has been provided that said working method may be applied also to unit of boxes with bearings for the hubs of the wheels of the motor vehicles, different from these above mentioned and substantially of the type indicated by reference P schematically shown in the Figure 1 of the attached drawings, which comprise a box 1 which is integrally carrying the flange 101 to be machined on the visible face with the tool 2 and which with its lateral and internal surface forms the external crown for the rolling

means 3 of the bearings, which co-operate with internal crowns 4 reciprocally connected with elastic means 5. To effect the machining of workpieces P of this kind, in the SKF patent application it is provided that, as shown in Figure 1, one of the internal crowns 4 of the bearings is resting with its external end on the flat and horizontal surface 106 of the unit 6, on which the whole of the same internal crowns 4 is secured and axially pre-loaded by means of a pin 7 which axially passes through with clearance said crowns 4 and which with its head 107 rests on the external end of the crown 4 opposed to the one resting on the surface 106. The pin 7 is axially pulled in the direction indicated by the arrow 8, in such a manner to pre-load the internal crowns of the bearings substantially with the same entity of pre-load which is given to same during the assembling phase of the workpiece on the hub of the wheel, in such a manner that the same workpiece results to be substantially machined in the same conditions in which it is during the utilization phase. The box is then carried in rotation by the known driver 9, while its flange 101 is machined by the tool 2. The solution shown in Figure 1 has resulted to be not usable in the industrial scale, for the difficulty of positioning of the pin 7 and of the workpiece on the supporting structure and for the difficulty to axially align the same workpiece with good precision with respect to the whole structure for supporting and driving in rotation. The main object of the invention is the realisation of an apparatus which can ensure rapidity, precision and complete automation in the work positioning of the said workpieces P having the flanged box and with internal bearing for the hubs of the motor vehicles. According to the invention, the pin 7 is overturned and is co-axially inserted in the driver 9 with possibility of relative movement with respect to the same driver. The internal crown of the bearing which is resting on the reference flat surface co-operates with a centring pin which may be provided with movable and active members for the same centring.

Further features of the invention, and the advantages deriving therefrom, will appear better evident from the following description of a preferred embodiment of same made, by way of non-limiting example, with reference to the figures of single attached sheet of drawing, in which, in addition to the already considered Figure 1, it is noted that Figures 2 and 3 show with the same outline of Figure 1, with portions in

section and with other portions in view, the apparatus which is referred to in two following steps of its working cycle.

From Figure 2 it is noted that the frontal and visible surface on the lower ring 4 of the inner bearings of the workpiece P, rests on the flat and horizontal surface 106 of a vertical mandrel 206 of the station 6 which in the machine tool provides to the right positioning of the said workpiece with respect to the several operating members of the apparatus which is referred to. The mandrel 206 is provided with a cylindrical and coaxial pin 306 which axially engages, completely or partially, at least the lower ring 4 of the bearings of the workpiece or which engages also a portion of the upper crown of the same bearings and this pin may have a diameter which may co-operate with the crown/crowns 4 with sufficient precision, or may co-operate with clearance with said crowns 4, in which case the pin 306 may be provided with lateral devices 10 radially movable with self-centring movement, which may be activated to ensure a precise axial alignment of the workpiece upon the mandrel 206. When the workpiece P is assembled upon the mandrel, the means 10 are initially in the back position and only in a second time they are activated in order to align the same workpiece with precision on the mandrel. The action of the means 10 on the crown 4 of the bearing is soft in order to not cause deformations and to allow to the workpiece the whole required axial displacement freedom for the phases of axial pre-charging (further described) of the bearings. Usefully, the front in view of the pin 306 is tapered in order to favour the automatic placing of the workpiece on the mandrel 206 by means of manipulating grippers of the machine, connected for example to the slide movable on orthogonal axis, which carries the working tool 2. The mandrel 206 may be a fixed apparatus, as provided in the patents mentioned in the introduction, or may an apparatus which upon command may rotate around its axis with the control of speed and phase regulation means.

Always from Figure 2 it is noted that once the workpiece P is placed in the station 6, there intervenes the second slide with orthogonal movements of the machine, upon which there is assembled the driver 9 which according to the invention is axially hollow and carries internally a rod 7 with a lower head 107 having

a diameter which is smaller than the one of the axial cavity of the box 1 of the workpiece P. The portions 7 and 9 are reciprocally uncoupled both in the axial movements and in the rotatory movements and are controlled by own means, not shown because easily conceivable and realisable by persons skilled in the art. The rod 7 is, at the beginning, extended from the driver 9 with its head 107, in such a manner to be lowered with this inside the box 1 and to be brought to rest with the same head on the upper crown 4 of the bearings of the workpiece P, to subject the bearings to an axial pre-loading which is proportionate to the one of the utilization conditions of the workpiece. In a following phase the driver 9 is lowered on the box 1 in such a manner to frontally engage it on the internal or on the external diameter, as shown for example in Figure 3. The driver 9 is connected to rotation and stop means, while the rod 7 or at least its head 107 is preferably freely rotatable around its axis.

Once the axial pre-loading of the internal crowns 4 and of the bearings by means of the presser 7, 107 is effected, the driver 9 can rotate the box 1 with the relative flange 101 for the working by the tool 2, while the mandrel 206 remains motionless, or preventively the driver 9 may be held motionless and the mandrel 206 may be rotated together with the internal crowns 4 of the bearings, while the surface to be machined of the flange 101 is controlled by a feeler placed for example on the same slide which carries the unit 9, 7, 107 and which detects the features of the runout, to correctly control the following working phases of the same flange by the tool 2. The working of the flange 101 may be performed with the mandrel 206 stopped in any angular position or prearranged angular position related to the features of the detected runout, or the same mandrel may rotate around its axis with a correct relative motion with respect to the external box 1. Once the working phase of the flange 101 is finished, the above mentioned operation for the measuring of the runout may be performed again for control purpose.

Once the working phase of the flange 101 is finished, the driver 9 is axially moved away form the workpiece P, then is moved away the presser 7, 107, and then the possible centring means 10 of the pin 306 are neutralised and the machined workpiece in moved away by means of the grippers of the working machine (not

shown). It is to be understood that if it is imposed by particular conditions, the unit 9, 7, 107 may be pre-arranged with clamping means to act also like a gripper, for example for the discharging from the station 6 of the machined workpiece while in this one there is positioned by other means a following workpiece P to be machined.